

# INSULATION CORKBOARD CARBON CONTENT AND CO<sub>2</sub> EQUIVALENT

L. GIL\*, N. MARREIROS, P. SILVA

Laboratório Nacional de Energia e Geologia, I.P., Unidade de Engenharia de Produto, Estrada do Paço do Lumiar, 1649-038 Lisboa, Portugal

\* [luis.gil@lneg.pt](mailto:luis.gil@lneg.pt)

**ABSTRACT:** In this work the carbon content of insulation corkboard (ICB), an insulation (thermal, sound and vibration) material based on cork is quantified and based on this the CO<sub>2</sub> equivalent is determined, in order to evaluate the capacity of CO<sub>2</sub> sequestration of this material in comparison with other competitive materials, namely for building applications (sustainable construction).

**Keywords:** carbon content, CO<sub>2</sub> equivalent, insulation corkboard, sustainable construction

**RESUMO:** Neste trabalho é quantificado o teor de carbono do aglomerado expandido de cortiça (ICB, da sigla em inglês), um material isolante (térmico, acústico e vibrático) à base de cortiça e com base neste teor é determinado o valor de CO<sub>2</sub> equivalente, de modo a avaliar a capacidade do sequestro de CO<sub>2</sub> por este material em comparação com outros materiais concorrentes, nomeadamente para aplicações em construção civil (construção sustentável).

**Palavras-chave:** teor de carbono, CO<sub>2</sub> equivalente, aglomerado expandido de cortiça, construção sustentável

## 1. INTRODUCTION

Insulation corkboard (ICB) is a construction material based exclusively on cork. It is a product made of granules of cork which are expanded (steambacked) in autoclaves and agglomerated together by means of pressure and temperature without any exogenous glue. This material is produced with the lowest quality types of cork but it has very good properties for some applications. Insulation corkboard applications are divided in three aspects: thermal insulation, acoustical absorption, vibration insulation. The first application is the most important nowadays. Acoustical corkboard, for acoustic correction is fabricated from specially selected raw materials, using granules of smaller caliber and showing lower density.



Fig. 1. Insulation corkboard sample.

For vibration insulation higher densities are used, until a limit imposed by the manufacturing process.

This agglomerate is exclusively made of cork granules (mainly from winter virgin cork) of a larger size (usually 5-20 mm) than those used in composition cork. The granules are bonded by their own resins in molds defined by the autoclave walls. The granules are placed into an autoclave, undergo light compression and then steaming occurs at more than 300°C. Steam promotes heat expansion which represents an increase in cell volume and so the granules are compressed against each other and in the boundaries the cells collapse and bind. Besides this the passing of the steam removes some chemical compounds of the cork cell walls. Due to this two aspects (expansion/lower density, products extraction), the components content of ICB is different from cork raw material [1].

The carbon content and CO<sub>2</sub> equivalent of cork is already known [2][3][4], but these are not known for ICB. It is important to know these values in order to use them for some calculations mainly for comparison with other construction materials for similar applications. Green building and sustainable materials are concepts that are increasingly considered by engineers, architects and other technicians and even by consumers.

## 2. EXPERIMENTAL PART

The sample of ICB used in the carbon content test was obtained from a silo of the waste material obtained by the cutting of ICB blocks and the surface finishing (sanding) of ICB

plancks obtained, constituting a representative average composition of ICB production.

The carbon content was determined using the experimental method of the standard CEN/TS 15289 –*Solid Biofuel Determination of Total Content of Carbon, Hydrogen and Nitrogen. Instrumental Methods*. Three different samples were used. The experimental apparatus was an Automatic Analyzer CHN 2000 from LECO, using the method of combustion and IV detection.

### 3. RESULTS

The carbon content for the three samples were as follows:

% C Sample 1 – 65.0% (w/w)

% C Sample 2 – 64.7% (w/w)

% C Sample 3 – 64.1% (w/w)

ICB average %C – 64.6% (w/w)

Using the same calculation procedures as in [2][3], we know that the mass ratio of CO<sub>2</sub>/C is 3.664. So, for 1 kg of ICB, carbon corresponds to 0.646 kg and this value corresponds to 2.367 kg of CO<sub>2</sub>.

### 4. DISCUSSION

According to information obtained from the most important ICB production companies (Sofalca, Amorim), the overall annual production of ICB ranges from 80000-100000 m<sup>3</sup>. According to the European Standard 13170:2001 – *Thermal insulation products for buildings – Factory made products of expanded cork (ICB) – Specification*, the ICB apparent density is  $\leq 130$  kg m<sup>-3</sup>. So, considering an average value of 120 kg m<sup>-3</sup> for the apparent density and an average value of 90000 m<sup>3</sup>/year for the total ICB production, this last value corresponds to 10800 ton/year of ICB and on the other hand this corresponds to a CO<sub>2</sub> equivalent of more than 25500 ton/

year. According to [5] the average CO<sub>2</sub> emissions expected for 2011-2015 is of 130 g/ CO<sub>2</sub>/km, and considering the average annual mileage equivalent of 17500 km/year, the ICB annual production corresponds to the pollution of more than 11200 cars/year.

### 5. CONCLUSIONS

ICB has a significantly greater carbon content (64,6% w/w) than cork (55,2-59,9% w/w, see [2]). Due to this carbon content and to the fact that ICB has a very long useful life which can be extended afterwards – reutilization or re-granulation – [6], this is a material of election for green and sustainable building.

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